California Science

Earth Sciences

PATTERNS in the SKY

by Arlene Block

Vocabulary

axis
constellation
phases of the Moon
revolution
rotation

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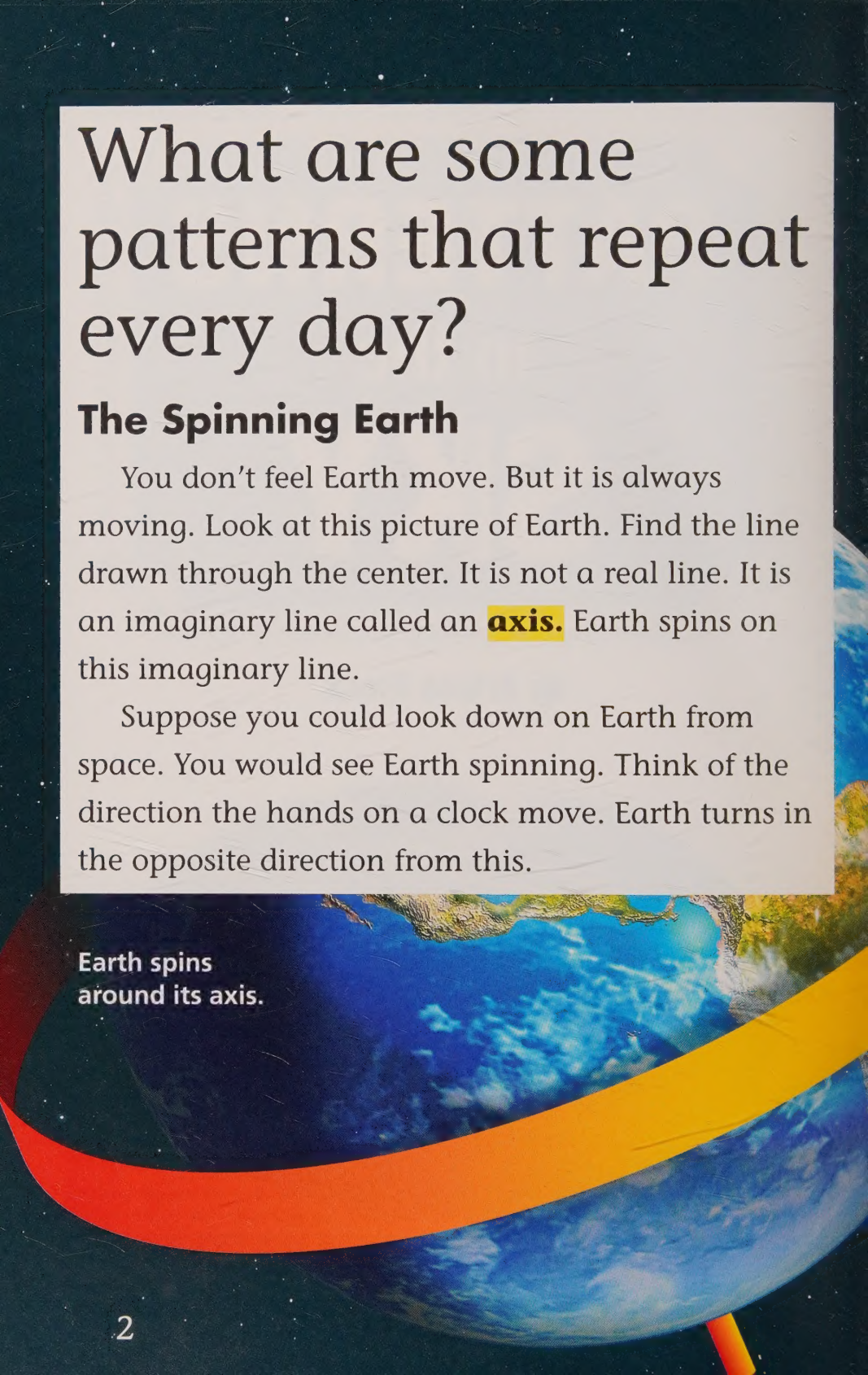
What are some patterns that repeat every day?

The Spinning Earth

You don't feel Earth move. But it is always moving. Look at this picture of Earth. Find the line drawn through the center. It is not a real line. It is an imaginary line called an **axis.** Earth spins on this imaginary line.

Suppose you could look down on Earth from space. You would see Earth spinning. Think of the direction the hands on a clock move. Earth turns in the opposite direction from this.

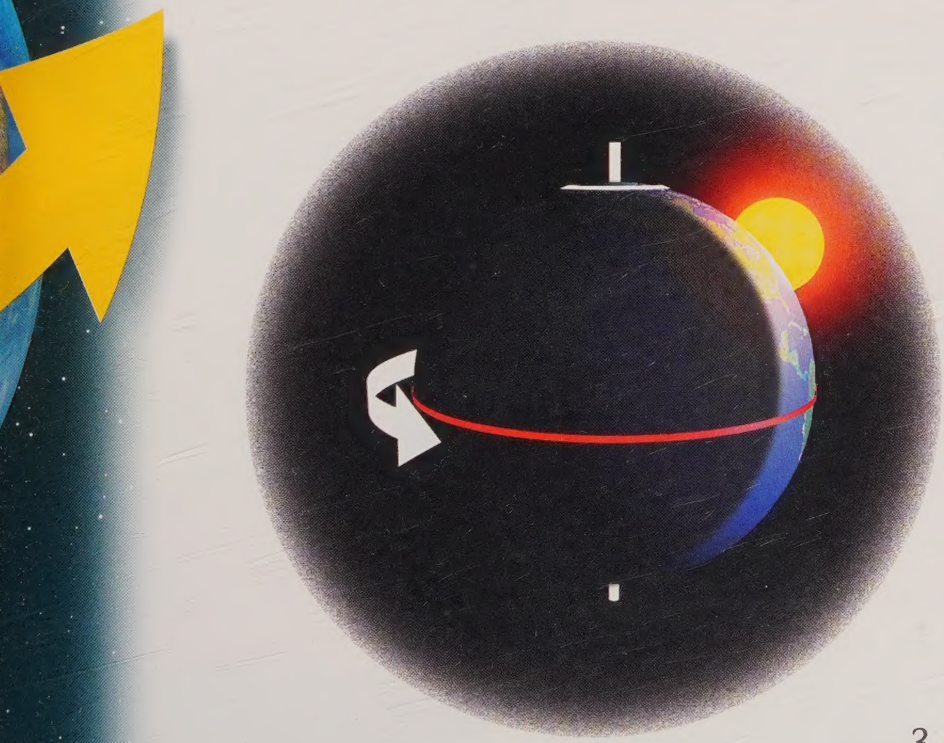


Earth spins around its axis.

Day and Night

Earth spins on its axis. It makes one complete spin, or **rotation,** every 24 hours. This causes day and night. As Earth rotates, half of Earth always faces the Sun. That side has day. The side not facing the Sun has night. This pattern repeats every day.

From Earth, it looks like the Sun is moving across the sky. But really, it is Earth that is moving!



As Earth rotates, this part of Earth is just starting to face the Sun.

Shadow Patterns

A shadow forms when sunlight hits an object. The size of a shadow changes during the day. That is because the Sun's position in the sky seems to change.

Shadows become shorter as the Sun appears to move higher in the sky. At noon, the Sun appears to be overhead. Shadows are very short. The Sun seems to continue moving across the sky. Shadows get longer toward sunset.

The Sun appears to rise in the east.

The Sun appears to move across the sky.

The Sun appears to set in the west.

Shadows also change direction during the day. They point away from the Sun. In the morning, the Sun is in the east. Then shadows stretch west. After midday, shadows stretch east. You can keep track of where the Sun is. Shadows get longer near sunset.

Morning

Midday

Afternoon

What patterns repeat every year?

Earth's Tilt

Earth rotates on its axis. At the same time, Earth moves around the Sun. It takes about one year to make a complete trip. Earth's trip around the Sun is called a **revolution.**

Look at Earth's axis in each picture. Do you see how it's tilted? Earth's axis always tilts in the same direction.

June It is summer in the northern half of Earth and winter in the southern half.

As Earth moves, different places are tilted toward the Sun. In some places on Earth's path around the Sun, the northern half of Earth is tilted toward the Sun. This half is called the Northern Hemisphere. During other times, the southern half of Earth is tilted toward the Sun. The part tilted toward the Sun gets the most direct sunlight. These places are warmed the most. The part of Earth that is tilted away from the Sun gets the least direct sunlight. These places are warmed the least.

March The northern half of Earth is getting warmer, but the southern half is getting cooler.

December It is winter in the northern half of Earth, but summer in the southern half.

September The northern half of Earth is getting cooler, but the southern half is getting warmer.

Seasons

The amount of sunlight changes in patterns. Changes in temperature also form patterns. These patterns are called *seasons*. You live in the Northern Hemisphere. There, summer usually has the warmest temperatures. Winter has the coolest temperatures.

The Northern Hemisphere is tilted away from the Sun in winter. It gets less direct sunlight. It has more hours of darkness than hours of daylight. This pattern changes in spring and fall. Earth's axis does not tilt toward or away from the Sun. There is about the same amount of daylight as darkness.

The Sun's Position in the Sky

The Sun appears to follow a path across the sky. The Sun appears in different places along this path in different seasons. This is because of Earth's tilted axis. During summer in the Northern Hemisphere, the Sun looks like it is nearly overhead. In winter, the Sun looks lower in the sky.

When the Sun appears higher in the sky, there are more hours of daylight.

The way the Sun appears to cross the sky changes with the seasons.

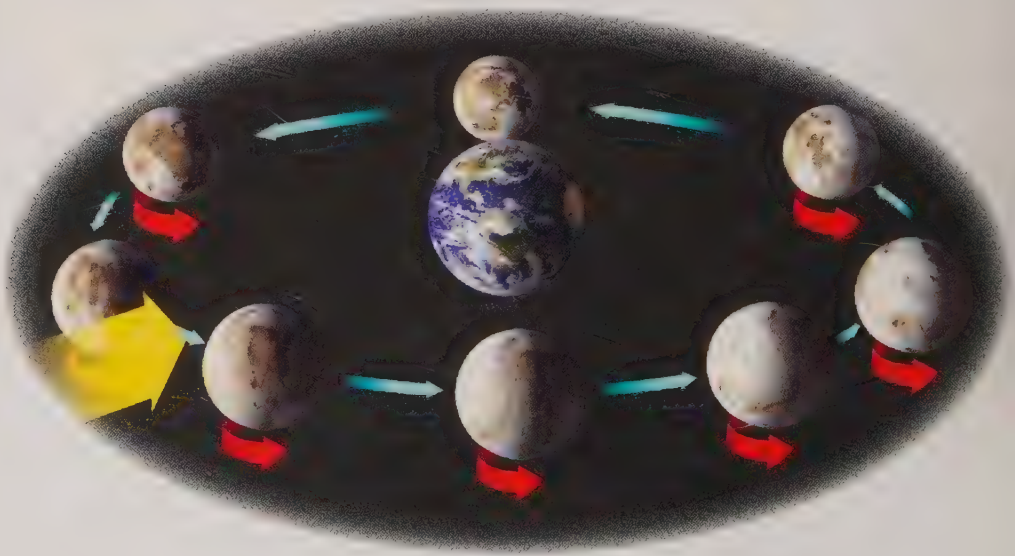
The picture shows the effects of Earth's tilted axis on the Sun's position and hours of daylight.

What are Moon and star patterns?

The Moon and the Sun

Have you watched the Moon? What does it look like? It looks different at different times. Sometimes you can't see it at all! At other times you can see it in the daytime. These changes are caused by sunlight and the motions of the Moon and Earth.

The Moon moves around Earth in a path. As it moves, the same side of the Moon always faces Earth.



Like Earth, the Moon rotates on its axis. The Moon revolves around Earth. One half of the Moon is almost always in sunlight. We see different amounts of this half. That's why the Moon seems to change shape. The changes are called the **phases of the Moon.** These pictures show the Moon's phases. The phases repeat in a pattern.

Star Patterns

What do you see when you look at the sky on a dark, clear night? You may see thousands of twinkling stars. Some of the brighter stars seem to be in groups. They make patterns or shapes. A group of stars that makes a pattern is called a **constellation.**

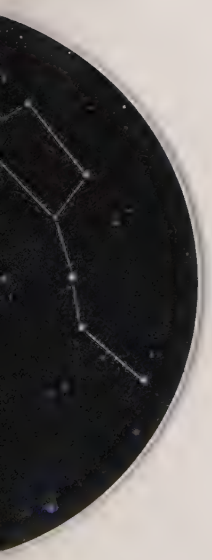
These pictures show patterns that look like cups with handles. The patterns are called the Little Dipper and the Big Dipper. They are parts of constellations.

The Dippers early at night in the summer

Go outside on a clear night. Look at the Little Dipper and the Big Dipper. Look at them again a few hours later. You may think they moved. They look that way because Earth rotates on its axis.

Find the Little Dipper in each picture. Do you see the star at the end of the "handle"? This is the North Star. It is over the North Pole. In the Northern Hemisphere, all the other stars seem to rotate around the North Star.

The Dippers three hours later

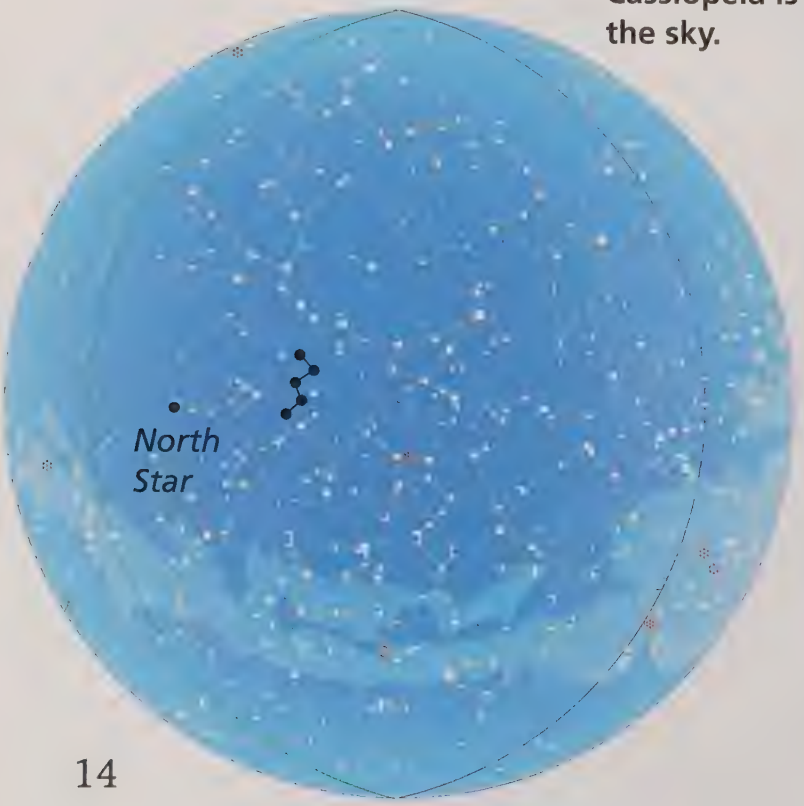


The Dippers six hours later

Star Positions in Different Seasons

Look at the sky on a clear summer night. You can see a group of stars that looks like the letter W. They are part of the constellation Cassiopeia. On a winter night, you cannot see Cassiopeia in the same place. Why? As Earth revolves around the Sun, we face slightly different parts of space. By winter, Earth has moved to the other side of the Sun. You see the night sky from a different direction.

In summer in the Northern Hemisphere, Cassiopeia is low in the sky.



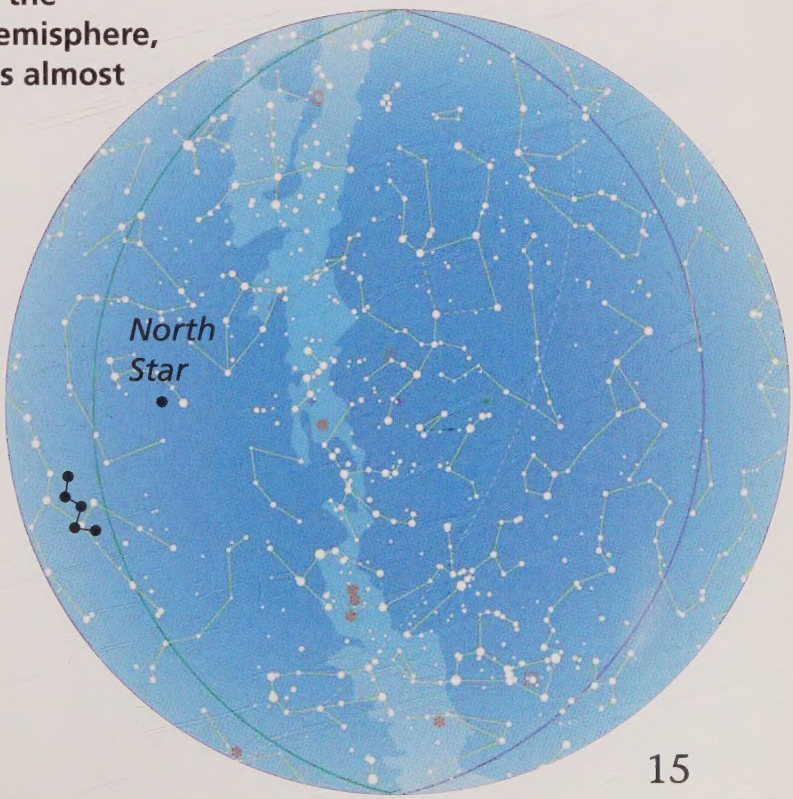
Different Stars in Different Seasons

The stars in Cassiopeia change position. But you can see them all year. Some stars can only be seen at one time of the year. Even though we can't see them, they are still in the daytime sky.

A Winter Sky Star Pattern

These stars are part of the constellation Orion, the Hunter. You can see them in the sky on a clear winter night. The position of Orion changes over several months. You cannot see Orion in summer.

In winter in the Northern Hemisphere, Cassiopeia is almost overhead.



Glossary

axis	the imaginary line around which the Earth spins
constellation	a group of stars that make a fixed pattern
phases of the Moon	set of each of the different ways that the Moon looks
revolution	one complete trip an object takes around another object
rotation	one complete spin on an axis

What did you learn?

1. How long does it take Earth to make a full rotation on its axis?

2. Does the Sun really move across the sky? Explain your answer.

3. How does what you see in the night sky change with the seasons?

4. **Writing** in Science You learned about the phases of the Moon. Suppose you look at the sky at the same time every night for a month. Write a paragraph that describes what you will see.

5. **Follow Instructions** Write steps for drawing a diagram of Earth revolving around the Sun as it rotates on its axis.

CALIFORNIA Standards Preview

California Science

Standard Set 4. Earth Sciences

4. Objects in the sky move in regular and predictable patterns. As a basis for understanding this concept:

4.a. *Students know* the patterns of stars stay the same, although they appear to move across the sky nightly, and different stars can be seen in different seasons.

4.b. *Students know* the way in which the Moon's appearance changes during the four-week lunar cycle.

4.e. *Students know* the position of the Sun in the sky changes during the course of the day and from season to season.

Genre	Comprehension Skill	Text Features	Science Content
Nonfiction	Follow Instructions	• Captions • Diagrams • Charts • Glossary	Sun, Moon, and Earth's Seasons

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